

INTERNSHIP REPORT TITLE PAGE

TITLE: Investigating the Arizona State Trauma System Based on a State Needs Assessment

SITE: Arizona Department of Health – Bureau of Emergency Medical Services and Trauma System

STUDENT NAME: Matthew Kingry

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STUDENT NAME: **Matthew Kingry**

STUDENT SIGNATURE: _____

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Investigating the Arizona State Trauma System Based on a State Needs Assessment

Abstract

Purpose

The objective of this report is to determine if the current legislation enacted to create an open designation process for the organizations of the Arizona State Trauma System is adequately meeting the needs of the residents of the state.

Methods

Data was collected from the Arizona State Trauma Registry (ASTR) and the Arizona Hospital Discharge Database (AHDD). Trauma data were analyzed by zip code of incidence, age, injury severity, and site transfer status - and were graphically depicted using arcGIS.

Results

There are no nearby Arizona State Trauma System designated hospitals for some areas of high density trauma incidence. Rural Arizona shows the greatest disparity of trauma center availability and the greatest potential for targeted system growth.

Discussion

The Arizona State Trauma System currently uses an open designation system. Any qualifying hospital can apply for state designation as a trauma center. This legislation was designed to increase overall participation in the trauma system. However, based on the findings of this project, improvements are still needed to achieve optimal statewide trauma system coverage.

Accidental Injury and the Role of a Trauma System

Unintentional traumatic injury is an important public health concern. Trauma is estimated to be responsible for over 161,000 deaths per year, with an estimated annual mortality rate of 55 per 100,000 persons.¹⁴ The 2010 U.S. Census data lists accidents or unintentional injuries as the 5th leading cause of death nationwide. When stratified by age, unintentional injury is the leading cause of death for two age groups – 1 to 24 years of age and 25 to 44 years of age.²⁴ Moreover, injury causes on average of 36 life-years lost per death compared with 12 years for heart disease and stroke combined, and 16 years for cancer.²¹ In addition to the medical, psychosocial, and financial burdens placed on individuals, families, and hospitals; our society at large is profoundly affected by injury. The financial cost of injury to society – including the costs of acute in-patient rehabilitation, post-acute residential rehabilitation, day treatment programs, and loss of productivity - is estimated at more than \$224 billion annually.^{14,23} The human and financial costs of injury and trauma are addressed in Healthy People (HP) 2010 as well as HP2020. In fact, HP2020 has numerous objectives for injury and violence prevention - many directly related to trauma care and the reduction of intentional and unintentional injury:⁴²

- Fatal and non-fatal injuries;
- Fatal and non-fatal traumatic brain injuries;
- Fatal and non-fatal spinal cord injuries;
- Motor vehicle crash-related deaths;

- Increasing use of safety belts, and age-appropriate vehicle restraint systems use in children;
- Increasing access to trauma care in the U.S.

Health experts make an important distinction between accidental and unintentional injury. Accidental implies an unexpected occurrence or an event happening by chance, whereas an unintentional injury is a definable correctable event with specific risks for occurrence, and thus can be prevented.¹ Both trauma care and the prevention of unintentional injury are important public health issues.

When an injury occurs, it is important to provide effective, efficient, and appropriate level trauma care as quickly as possible. The American College of Surgeons (ACS) stresses the importance of a systematic approach to trauma care encompassing the entire “community”.³ In our state, the Arizona Department of Health Services (ADHS) has adopted a national standard in trauma care, the “Golden Hour,” which calls for patients with traumatic injuries to receive definitive surgical care at designated trauma centers within one hour following their injuries. To accomplish this, statewide trauma systems promote timely inter-hospital transfers to tertiary trauma centers from lower level trauma centers through prearranged protocols; emphasizing the importance of a coordinated systems approach to ensure optimal care and adherence to the “Golden Hour” standard.¹⁶ ACS clearly defines the role of each level of trauma care facility as follows:

- Level I Trauma Centers – “Should be a regional resource center and generally serves large cities or population dense areas.” This institution is responsible for the highest level of care and is considered the lead head hospital for a system.³
- Level II Trauma Centers – “Should provide comprehensive trauma care in two distinct environments.” A Level II Center may supplement the clinical activity and expertise of a Level I institution as well as serve as the lead trauma facility when a Level I institution is not geographically close or in less population dense area.³
- Level III Trauma Centers – “Should have the capability to initially manage the majority of injured patients and have transfer agreements with a Level I or II Trauma Center.”³
- Level IV Trauma Centers – “Are usually located in rural areas and supplement care within the larger system. Level IV facilities provide initial evaluation and assessment of injured patients, but most patients will require transfer to higher level trauma centers.”³
- Level V Trauma Centers – Level V Trauma Centers are not formally recognized by the ACS, however, numerous states use them to further categorize hospitals providing life support prior to transfer.²¹

Trauma facilities have in-depth staffing and trauma volume requirements that are not included in the general descriptions listed above. They work in cooperation to deliver a traumatically injured patient to the proper facility for treatment and care.

Trauma care has undergone tremendous change in North America over the past 30 years. The regionalization of trauma care has shifted the scope of management of the trauma patient from an individual, hospital-based approach to a systems approach.¹⁷ A systems

approach includes all of the components associated with optimal trauma care – prevention, access, acute hospital care, rehabilitation, and research activities.³ Trauma systems require state emergency medical services (EMS) statutes and regulation for system funding and administration. According to the National Highway Traffic Safety Administration (NHTSA), the infrastructure of an integrated trauma care system includes eight key elements: leadership, professional resources, education and advocacy, information, finances, research, technology, and disaster preparedness and response. In a model system, these elements are integrated and coordinated to provide cost-efficient and appropriate services across the continuum of care.³¹ The Health Resources and Service Administration (HRSA) formally defines a trauma system as, “A pre-planned, comprehensive, and coordinated statewide and local injury response network that includes facilities with the capability to care for the injured”.¹⁴ HRSA goes on to state that the overarching goals of a trauma system are: decreasing the incidence and severity of trauma; ensuring optimal, equitable, and accessible care for all persons sustaining trauma; preventing unnecessary trauma-associated deaths and disabilities; containing costs while enhancing efficiency; implementing quality and performance improvement of trauma care throughout the system; and ensuring certain designated facilities have appropriate resources to meet the needs of the injured.¹⁴

Trauma Systems in the U.S.

The development of basic trauma systems date back World War I when timely evacuation of the wounded was first implemented with the idea of transporting more seriously wounded patients to facilities with greater capabilities and established protocols.²⁷ It was from

this system that the concept of triage evolved. Triage, derived from the French verb *trier*, to pick or to sort, was used in the context of assigning levels of urgency to the treatment of military casualties.¹¹ As the military's system for providing trauma care became more established and coordinated, it was noted that survival improved.²⁷ While much has been learned from the military experience, large municipal hospitals in major cities have also had a significant influence on the treatment of injured patients throughout the past century.²⁷ As teaching and training programs in large municipal hospitals grew, it became apparent that a trauma system could improve outcomes if injured patients were preferentially transported to hospitals with special commitments to trauma care.²⁷

In addition, many experts have identified the National Academy of Sciences' 1966 publication *Accidental Death and Disability: The Neglected Disease of Modern Society* as the inaugural event in what was to become a sustained effort by government to address "accidental injury" as a health problem.²⁷ This publication outlines accidental injury as a neglected epidemic of modern society and asserts that it is the nation's most important environmental health problem. It called for the public's apathy toward the mounting toll from accidents to be transformed into action under strong leadership.²⁹ However, neither "how" to implement nor "who" would implement many of the publication's recommendations was addressed.⁸

This was soon remedied by a number of laws that were passed to address both the "how" and "who" in implementation. The first, the National Highway Safety Act of 1966, calling for the implementation of a highway safety program designed to reduce traffic accidents and

deaths, injuries, and resulting property damage.³⁰ Three states - Maryland, Florida, and Illinois, capitalized on federal programs funded by the National Highway Safety Act of 1966 to pioneer the development of regional emergency medical service programs, including trauma systems.²⁷ Congress amended the Public Health Service Act by enacting the Emergency Medical Services Systems (EMSS) Act of 1973 (Public Law 93-154), as amended in 1976 and 1979. The EMSS provided grant funds for planning and implementation, trauma systems expansion, and technical assistance to develop a national program of regional trauma and EMSS.⁸ In 1990, the federal Trauma Care Systems Planning and Development Act was passed to improve EMS and trauma care, and funds were appropriated to improve these areas through system improvement.³² Funding expired in 1995 but was renewed in 2000 and 2001.

The literature indicates some positive effects from the development of standardized trauma systems. One study, examining motor vehicle crash mortality across all 50 states, showed traffic-crash mortality began to decline 10 years following trauma system implementation, with an 8% reduction 15 years following implementation.²⁸ In Delaware, a study published after the implementation of an inclusive state trauma system shows a decrease in mortality that was entirely attributed to the reduced mortality system-wide of trauma patients with an Injury Severity Score (ISS) - a common tool used by EMS to assess the severity of traumatic injury – greater than 24. The data shows a decrease in mortality for these severely injured patients of approximately 3% per year, significantly better than the decrease observed in the same category of trauma patients in the National Trauma Database (NTD).³⁸ Similarly, researchers in Montana observed that implementation of their state's trauma system resulted

in a statistically significant 5% decrease in the overall preventable death rate, as well as a 12% decrease in the preventable death rate in hospitals.¹² Cities have also reported the benefits of both trauma centers and integrated trauma systems. San Diego, California, reported that after the implementation of a regionalized trauma system, the percentage of potentially preventable deaths dropped from 22% to 10%.¹⁹ Thus the literature on the benefits of integrated trauma system in terms of the potential reductions in morbidity and mortality is quite extensive.

Arizona State Trauma System

The Arizona State Trauma System is relatively new. Its Division of Emergency Medical Services was founded in 1981 through the passage of Arizona Revised Statute (ARS) §36-2208. Four regions – Central Region, Southeast Region, Northern Region, and Western Region – were developed to allow smaller governing bodies that could review and assess the systems in place for quality improvement and attend to the needs of their constituents.

In 1994, with the passing of ARS §36-2222, the State Trauma Advisory Board (STAB) recommended standards to establish a statewide trauma system and a trauma registry. In 1999, STAB developed trauma plan recommendations that were presented to the Director of the Department of Health Services. In 2002, the Arizona EMS and Trauma System Plan was approved and adopted. In 2004, House Bill 2197, introduced in the Arizona Legislature, required the Department of Health Services to develop and administer a statewide emergency medical services and trauma system.

In November of 2005, John C. Lincoln Hospital-North Mountain in Phoenix was the first valley hospital to apply and receive state designation as a Level I Trauma Center. Shortly thereafter (in 2005), Scottsdale Healthcare-Osborn, St. Joseph's Hospital & Medical Center, Maricopa Medical Center, Flagstaff Medical Center, and University Medical Center in Tucson also became designated Level I Trauma Centers. In early 2006, Banner Good Samaritan Medical Center became Arizona's seventh designated Level I Trauma Center in Arizona and the fifth such center in the Phoenix metropolitan area. In 2008 Arizona added Phoenix Children's Hospital as the eighth and final Level I Trauma Center to date.

In June of 2007, ADHS invited the American College of Surgeons Committee on Trauma (ACS-COT) to perform a trauma system consultation. In their report, the ACS-COT identified, inter alia, the following issues:

- It could take as long as several hours for an injured patient to get to a Level I Trauma Center (because of rural access issues, trauma center bypass issues, and the distance).
- The trauma center distribution was not based on a formal needs assessment plan and the distribution and level of trauma centers might not be optimal.
- The need for mechanisms to encourage verification and designation of Level II, Level III, and Level IV Trauma Centers.²

In response, ADHS invested significant resources to address the issues identified. In an 18-month follow-up report generated by the Bureau of EMS and Trauma Systems (BEMSTS) it identified numerous actions, including: developing a cost/benefit analysis to encourage rural

hospitals to join the system, and encouraging all non-participating hospitals licensed by the state to submit to the Arizona State Trauma Registry (ASTR).⁷

In 2008, Summit Healthcare Regional Medical Center in Show Low became Arizona's first state designated Level IV Trauma Center. Eight more Level IV Trauma Centers were designated in the next three years, and six more in 2011. Virtually all of the Level IV Trauma Centers are located in Arizona's rural communities: Page, Benson, Chinle, Bisbee, Lake Havasu City, Kingman, Parker, Winslow, Willcox, Douglas, Show Low, Tuba City, Cottonwood, and Wickenburg; Mountain Vista Medical Center, is located in the large metropolitan area of Mesa. In February of 2012, two provisional designations were given out to Arizona's first Level III Trauma Centers in Mesa and Tucson.

Much work has been done on determining the optimal direction for the future of the Arizona State Trauma System. The current system for trauma designation within Arizona is set by Article 13, of Chapter 25, of Title 9 of the Arizona Administrative Code (AAC). It allows for any qualifying hospital to apply for state designation as a trauma center. This is essentially an open-designation process compared to the ACS-COT recommended needs-based process. Level I Trauma Centers are epicenters for the highest level of trauma care. However, to avoid excess health care costs and create the most efficient trauma system, ACS recommends limiting the number of designated trauma centers in any given community. This is intended to ensure the appropriate use of resources in achieving the stated goal of optimal care of injured patients.³

A trauma network that extends to all boundaries of a defined region is essential to a well-functioning trauma system. The ACS contends that the designating authority should be

responsible for determining the anticipated volume of major trauma patients and assessing available resources to determine the optimal number and level of trauma centers in a given area.³ ADHS and BEMSTS have shown a commitment to the development of such a system, defined as an inclusive trauma system, in Arizona. However, more analysis needs to be done in order to determine where there are gaps in coverage where there is redundant coverage.

Investigating the Trauma System through Policy Adoption and Implementation

Interning at the Arizona Department of Health BEMSTS helped this author develop a better understanding of policy and management issues as well as how a division in a State Health Department functions. The main focus of my internship was a policy analysis review of Arizona's current open-designation process of trauma centers. While there is no one correct way to decide a trauma center designation process, many states and the ACS, (the trauma hospital accrediting body in the U.S.), describe a designation process that is more needs-based. Over the course of this internship, I learned that policy analysis is a difficult and complex process. Policymaking is a process with political underpinnings that target a public benefit, and involve legislators, public administrators, and private constituents. Individuals with political, personal, and professional opinions and reasons can influence a particular policy. This internship provided the opportunity to begin understanding this process and the barriers to policy change. While interning at ADHS, numerous opportunities for learning arose that furthered my understanding of the functioning of a state department and the work of its employees.

Arizona Department of Health Services (ADHS)

ADHS's broad goal is to be responsible for Public Services, including: the Arizona State Laboratory, epidemiology and disease control, EMS and trauma, public health statistics, vital records, border health, tobacco education, minority health, behavioral health services, substance abuse treatment and prevention, etc. ADHS is formally comprised of eight divisions which include: the Office of the Director, Arizona State Hospital, Behavioral Health Services, Licensing Services, Planning and Operations, Public Health Services, State Laboratory Services, and Vital Records. The Bureau hosting this internship is part of the Division of Public Health Services. ADHS' mission is to set the standard for personal and community health through direct care delivery, science, public policy, and leadership, with the motto "Health and Wellness for All Arizonans." ADHS has an operating budget of approximately \$500 million – not including funding for the Arizona Health Care Cost Containment System (AHCCCS) which is approximately \$1.4 billion.¹³ Excluding the operating costs for AHCCCS, ADHS is the fifth largest operating budget behind the Department of Education, the Department of Corrections, University Systems, and the Department of Economic Security. An Organizational chart of ADHS can be found in Appendix A.5.

The Bureau of Emergency Medical Services and Trauma Systems (BEMSTS)

BEMSTS is comprised of five sections: Business Operations, Ambulance Training and Base Hospital, Certificate of Necessity (CON), Certifications and Enforcement, Data and Quality Assurance, and Trauma Development. The mission statement of BEMSTS is: *To protect the health and safety of people requiring emergency medical services; promote improvements in*

*Arizona's EMS and trauma system through research and education of the public and EMS providers; and provide courteous, professional and responsible service to the public and EMS providers.*⁴ BEMSTS has an annual operating budget of \$2.3 million and has experienced over a 30% cut in total budget allocations over the past few years. BEMSTS funding is directly appropriated by the Governor's Office of Strategic Planning and Budgeting and distributed annually. An Organization chart of BEMSTS can be found in Appendix A.6.

Project Goals, Proposed Outcomes, Learning Objectives, and Activities

Goals

- Gain practical experience in a state health department;
- Interact with multiple health departments and public health stakeholders, including other department members; other ADHS professionals; consultants; community members; and if necessary, public health professionals in other states;
- Keep open lines of communication between all involved members including my site preceptor, committee chair, and second committee chair;
- Maintain a professional appearance and attitude while representing myself, the University of Arizona College of Public Health, and the Arizona Department of Health Services;
- Carefully choose the problems I wish to address, and be realistic about what I can accomplish in a relatively short time frame; and
- Fulfill all the necessary requirements of the internship and meet all University of Arizona deadlines for a successful internship and qualify for graduation upon completion of my final semester in the fall of 2012.

Outcomes

- Create a well thought out public health internship that could be of benefit to the BEMSTS;

- Do a thorough literature review of EMS and trauma incidence and management in Arizona to better understand the processes currently in place, and how other states have created their systems.
- Look into the process of designating trauma centers based on need and the potential repercussions.
- Understand how the current Arizona State Trauma System was developed and how the state plans on advancing the system in the future.
- Understand some of the pushback that occurs when policy evaluation is mentioned and how to overcome these barriers;
- Create a method of statistical analysis for the distribution of trauma incidence across the state of Arizona;
- Build a positive reputation for myself for possible future employment in state government;
- Build a positive reputation for our school so that other MEZCOPH interns can use the Bureau of EMS and Trauma System as a future intern site if they so choose;
- Create thorough statistical analysis graphics displaying density graphs based on trauma throughout the state by hospital as well as zip code;
- Create a well-drafted internship report that demonstrates the skills and knowledge gained from my experience, including a greater understanding of Arizona's Trauma System and how it might be developed to best meet the needs of Arizonans now and in the future; and
- Develop a presentation to deliver in the MEZCOPH internship presentation seminar in the fall of 2012.

Table 1: Internship Learning Objectives/Activities

<i>Learning Objectives</i>	<i>Internship Activities</i>
To learn more about trauma systems nationally and in Arizona. <ul style="list-style-type: none"> - What is the ideal method of organization for a trauma system and what model best fits the geographical and other current realities? - How can the current trauma centers help strengthen trauma services across the state? - What is the best way to ensure that the system adequately serves rural 	<ul style="list-style-type: none"> - Do a thorough literature national review regarding trauma systems in theory and practice. - Learn about Arizona's trauma system, including its strengths and weaknesses through a review of the literature and data analysis. - Investigate the American College of Surgeons-Committee on Trauma's trauma classification system and learn how other systems use and interpret it.

Arizonans?	
Interview regional and state public health and health officials to gain a practical understanding of the technical, financial, and political issues facing the Arizona State Trauma System.	<ul style="list-style-type: none"> - Interview Terry Mullins ADHS Bureau of EMS and Trauma Systems Bureau Chief. Consider Interviewing ADHS Director Will Humble - Interview two hospital administrators from Level I Trauma Centers - Interview two members of paramedic teams and one director of an Ambulance transport service.
<ul style="list-style-type: none"> - Learn how to practically apply my skills in biostatistical analysis in a project setting. - Learn how to represent data so that is can be understood by all. 	<ul style="list-style-type: none"> - Use STATA for biostatistical analysis of trauma. - Create graphical representations of my statistical analysis, such as density graphs of the state by zip code and receiving hospitals. - Create graphical representations of potential trauma regions based on the result of my analysis.
<ul style="list-style-type: none"> - Synthesize what I've learned about Arizona's Trauma System, its origins, how it works, as well as current and future needs. - Learn how to present that information in writing and verbally in ways that are appropriate for my different audiences. 	<ul style="list-style-type: none"> - Develop a comprehensive final report for my site that includes information on the history of Arizona's Trauma System, its current strengths and weaknesses, and suggestions for future improvements - Develop a final report for UA MEZCOPH that meets that meets my internship requirements - Prepare my final internship oral report

Methods

Needs Assessment

A non-applicable student research form was filed with the University of Arizona IRB office on January 5, 2012. The approval was granted one day later January 6, 2012. A copy of the non-applicable form can be found in the Appendix A.4. Two Collaborative Institutional

Training Institute (CITI) certifications were obtained December 13, 2011 and copies can be found in the Appendix A.3.

The ASTR data was used to do a simple analysis of the trauma data by zip code, ISS, and Age. Statistical analysis software (SAS) was used to generate a report of 2009 and 2010 trauma numbers separated by zip code. SAS was then used to stratify the numbers into binary categories of age (≤ 14 , >14) to identify pediatric and adult traumas. Super categories were further created to split the data by ISS score into meaningful columns. A cutoff of ISS <15 was used to signify trauma incidences, that depending on co-morbidities and other possible injury severity factors, have the potential to be treated in Level IV Trauma Centers. SAS was also used to run an analysis on the source locations of trauma incidences referred to Level I Trauma Centers from the 2010 Arizona State Hospital Discharge database. This analysis was run excluding the urban counties of Maricopa and Pima. These results were again stratified into binary age categories (≤ 14 , >14) and further analyzed with ArcGIS to create map density plots by zip code. Jenks algorithm was used to create four (4) natural breaks in the distribution of the data to be represented. Layers of existing trauma centers were created using latitude and longitude coordinates. A duplicate of each map was created with an additional layer of potential trauma centers taken from the ADHS Licensing Service's Active and Pending Hospital Directory.

An exploratory analysis was run to examine the penetrance of the existing trauma centers. This exploratory tool is being analyzed as a future analytic tool in the determination of trauma system organization. The 2010 ASTR database was used to retrieve the total number of

traumas observed at each trauma facility excluding those in Maricopa and Pima Counties. Zip codes of site incidence were extracted from ASTR and used to define each trauma center's catchment area. The catchment areas represent the geographical service population, using zip codes as the definitive geographical boundaries, in which trauma centers receive their patients. Zip code population data was taken from the U.S. Census Bureau website. Trauma centers sharing incidences from zip codes were totaled and a percentage of the zip codes population was assigned to the facilities catchment area based on the percentage of incidences coming from each facility. Penetrance was calculated by dividing the number of traumas by the population of the catchment area and then multiplying this number by one thousand. The results of this analysis can be found below in Table 2.

Results

Figure 1. 2010 Patients Transferred from Rural Zip Codes that Contained an ISS < 15 to a Designated Level 1 Trauma Center

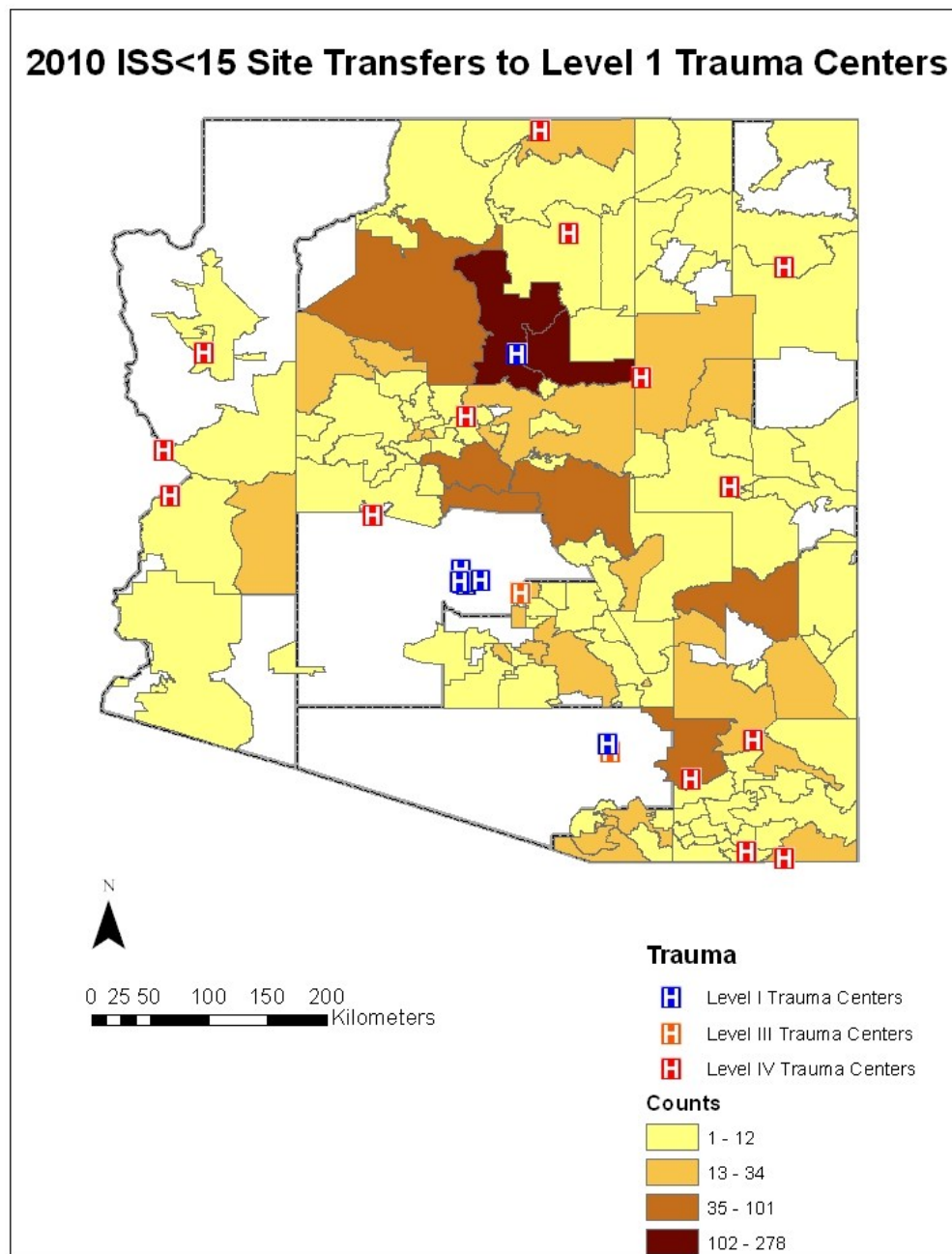


Figure 2. 2010 Patients Transferred from Rural Zip Codes that Contained an ISS < 15 to a Designated Level 1 Trauma Center with the Addition of Potential Trauma Centers

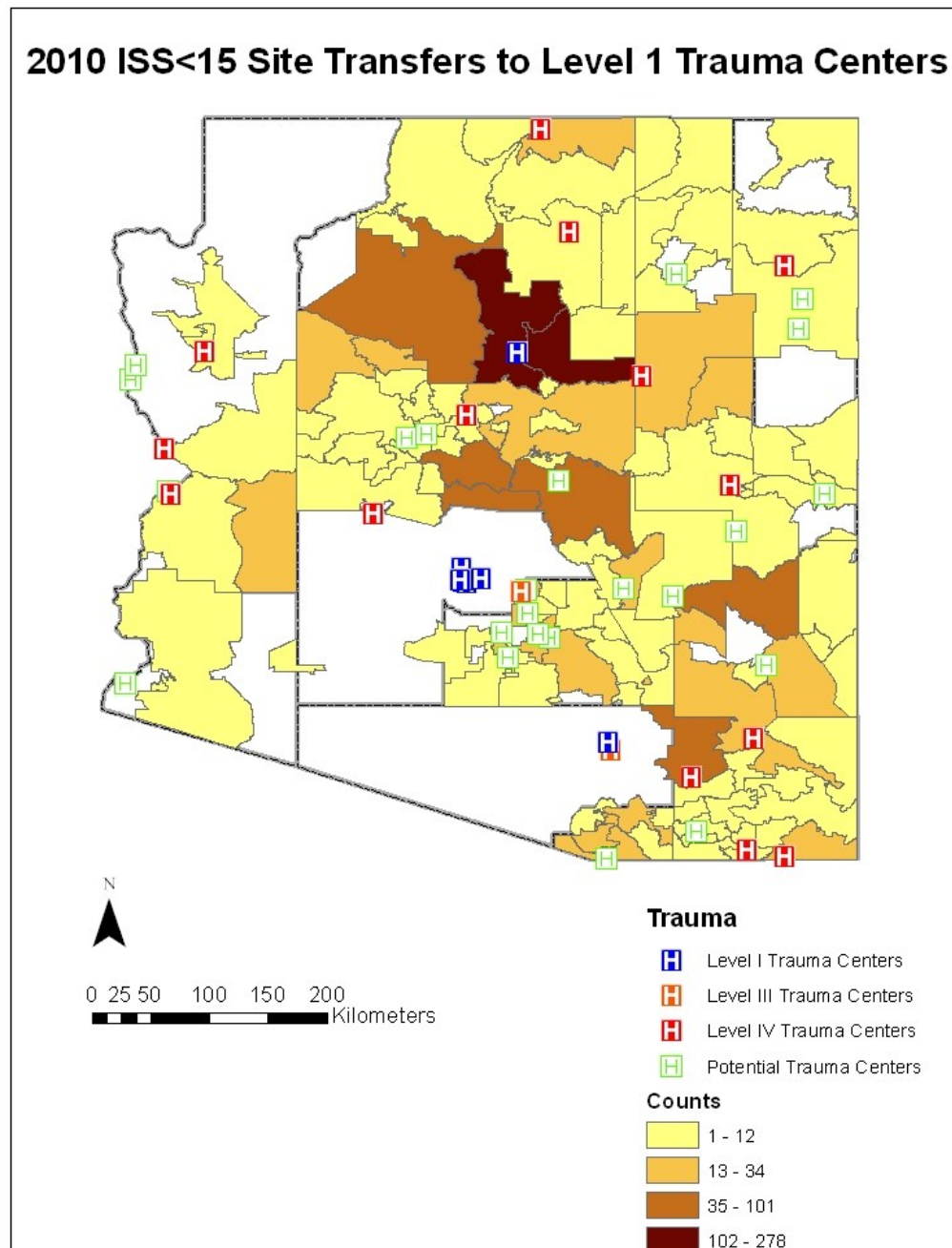


Figure 3. 2009 Pediatric Traumas (Age ≤ 14) with an ISS < 15 by Incident Site Zip Code

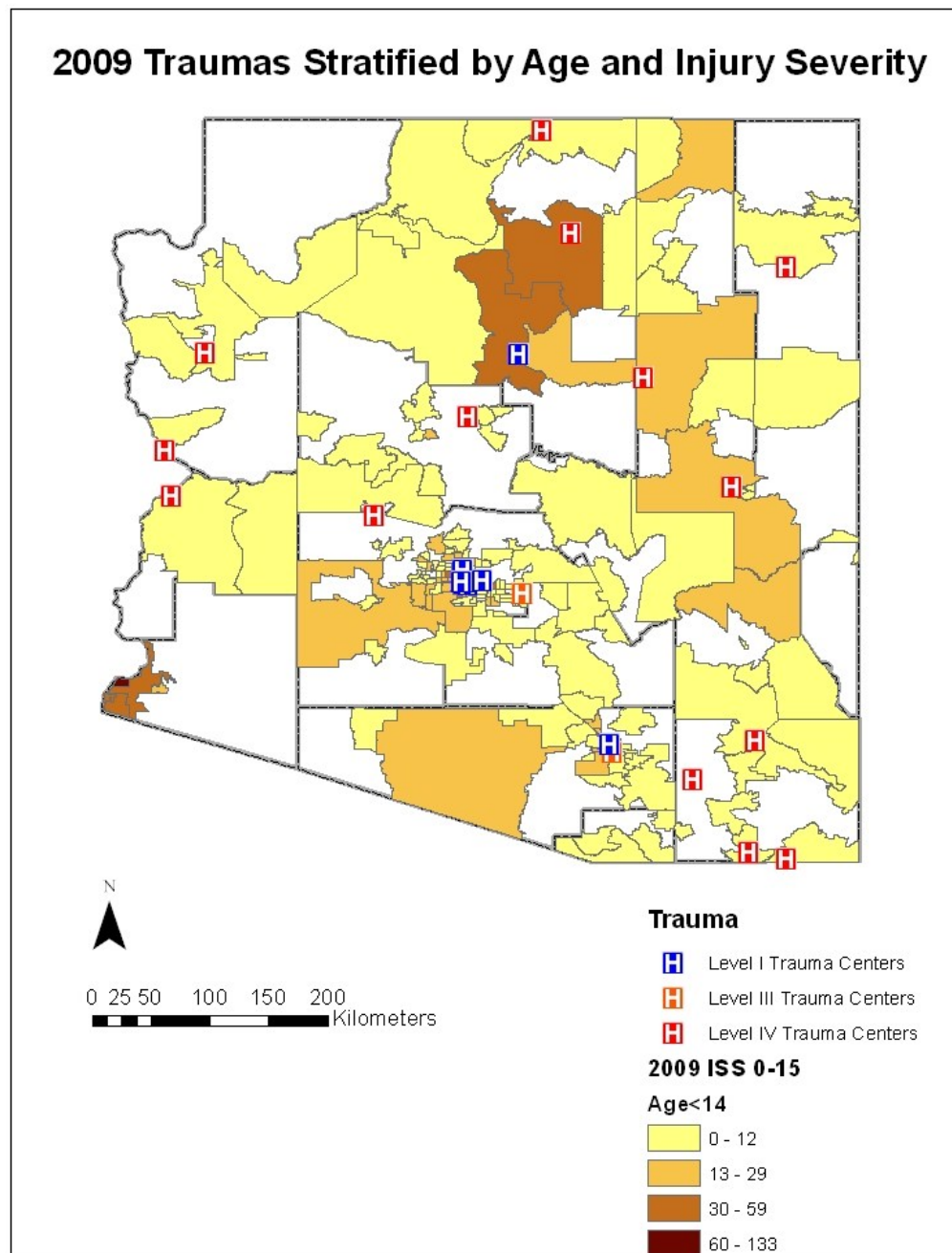


Figure 4. 2009 Pediatric Traumas (Age ≤ 14) with an ISS < 15 by Incident Site Zip Code with the
Addition of Potential Trauma Centers

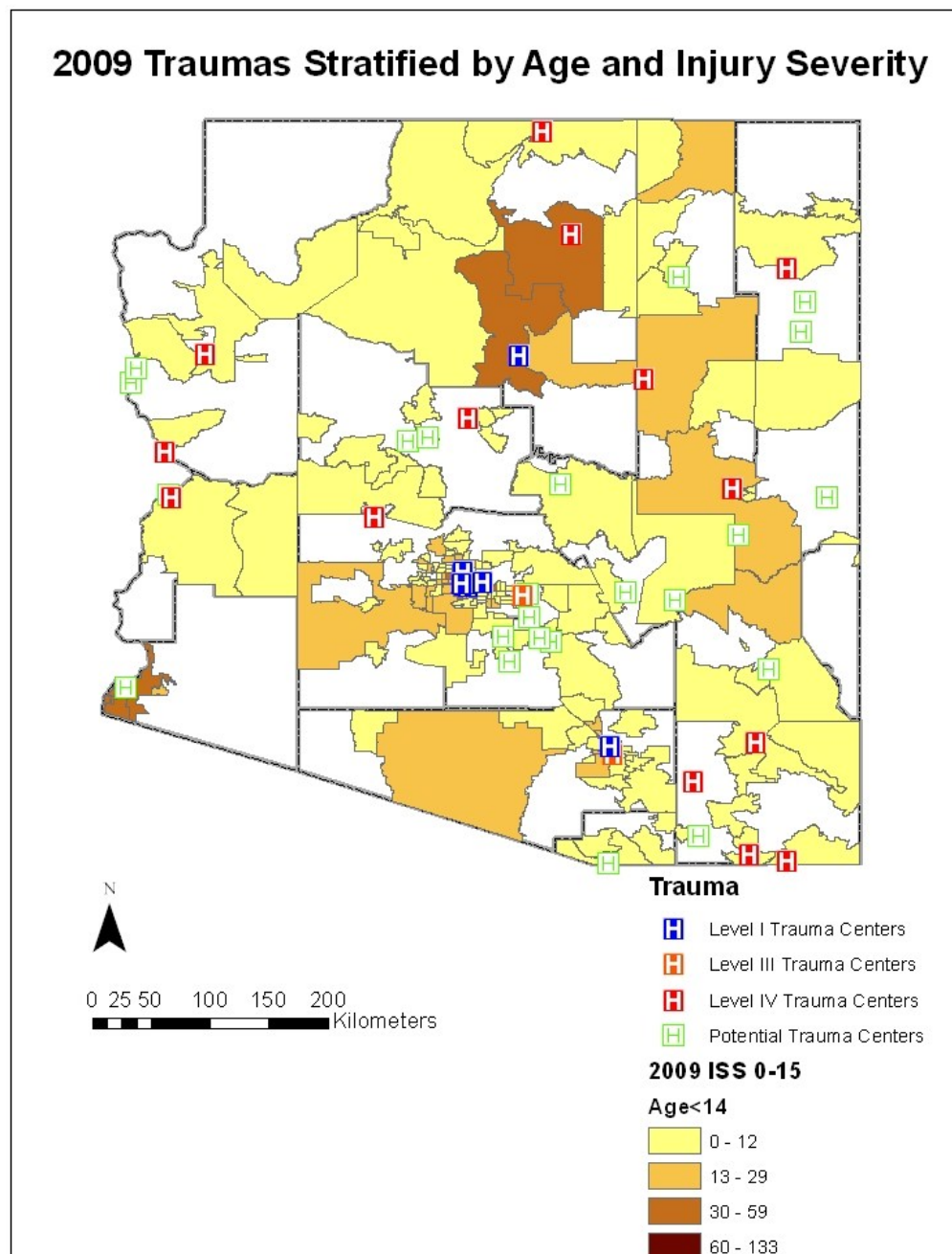


Figure 5. 2009 Adult Traumas (Age > 14) with an ISS < 15 by Incident Site Zip Code

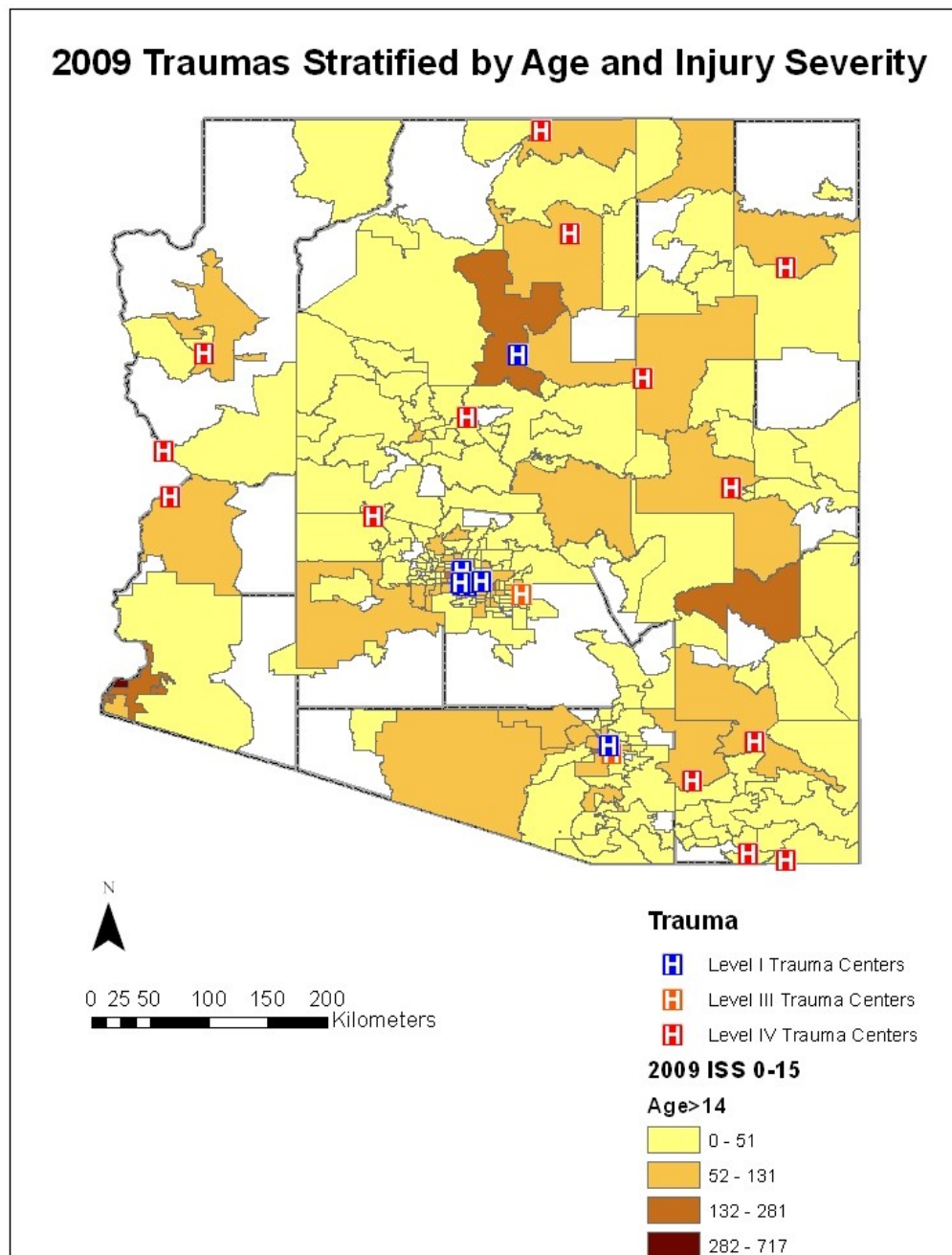


Figure 6. 2009 Adult Traumas (Age > 14) with an ISS < 15 by Incident Site Zip Code with the
Addition of Potential Trauma Centers

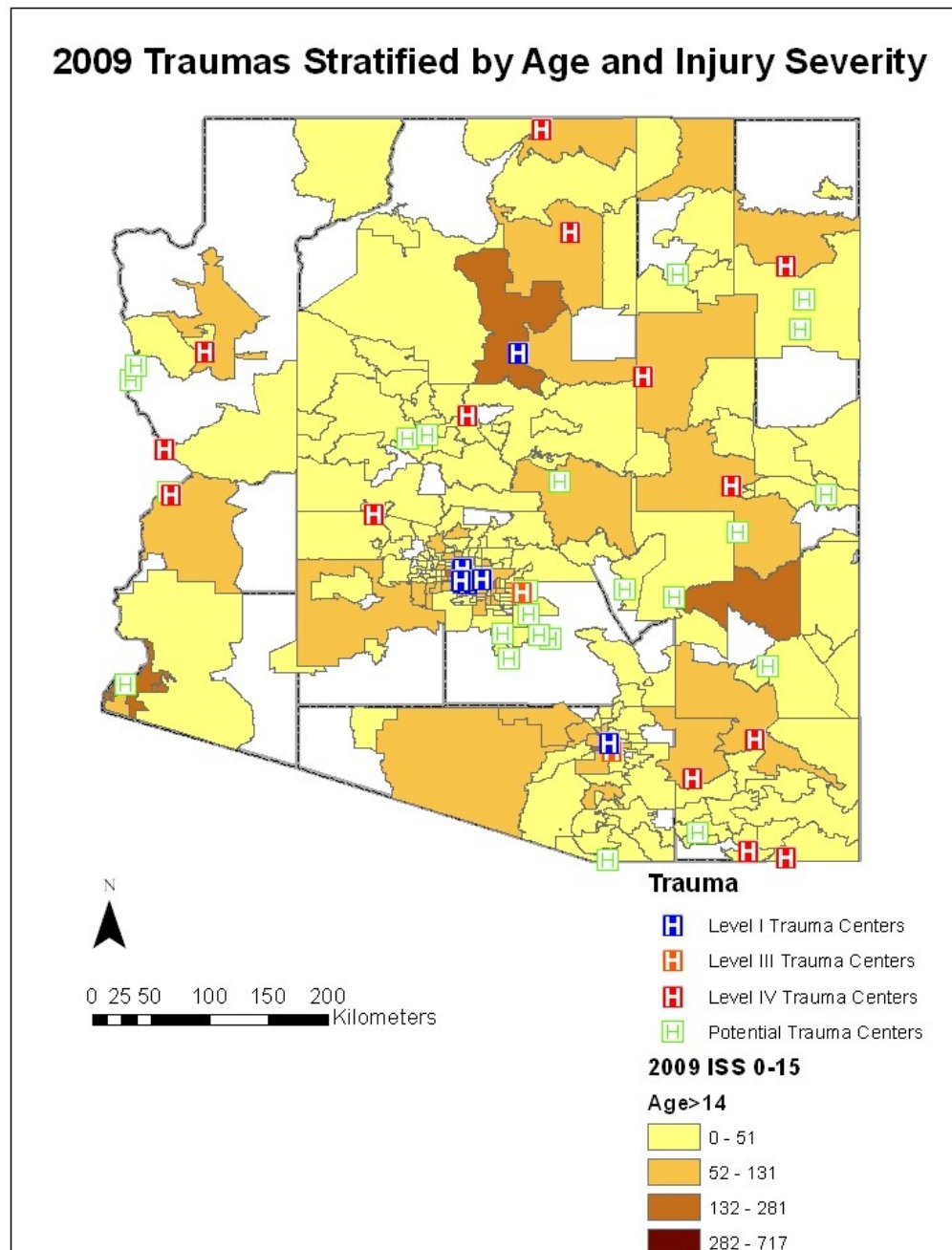
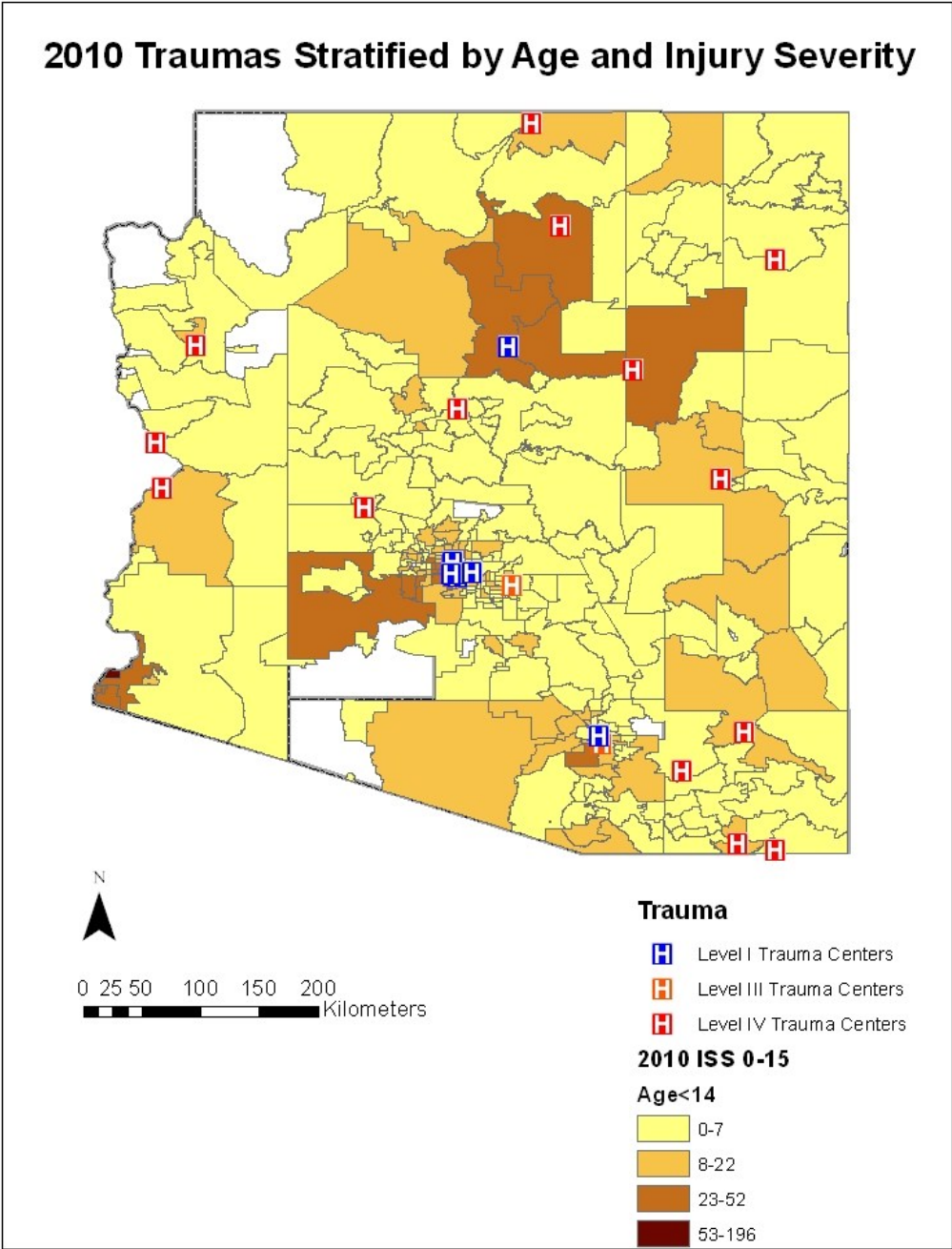


Figure 7. 2010 Pediatric Traumas (Age ≤ 14) with an ISS < 15 by Incident Site Zip Code



**Figure 8. 2010 Pediatric Traumas (Age ≤ 14) with an ISS < 15 by Incident Site Zip Code with the
Addition of Potential Trauma Centers**

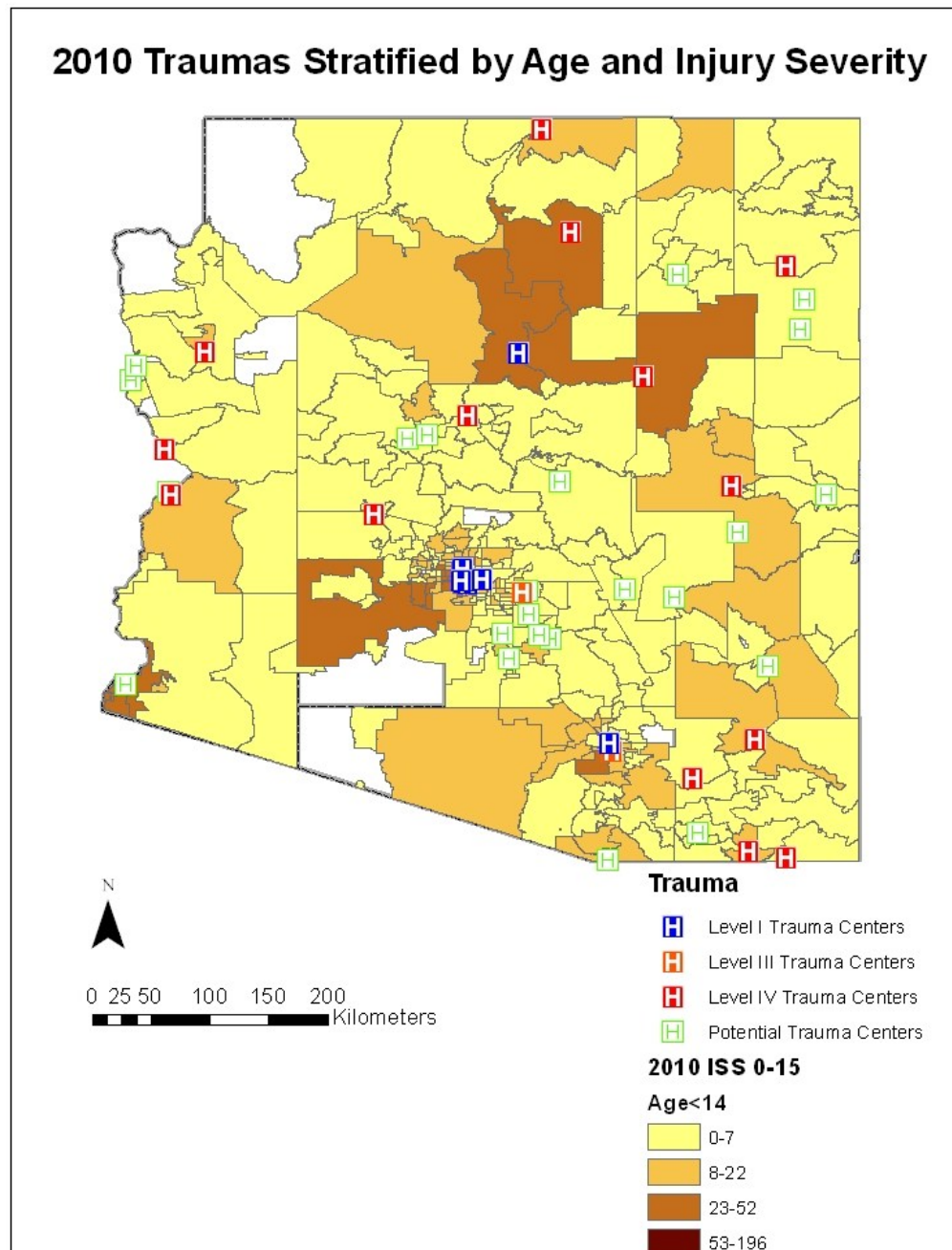


Figure 9. 2010 Adult Traumas (Age > 14) with an ISS < 15 by Incident Site Zip Code

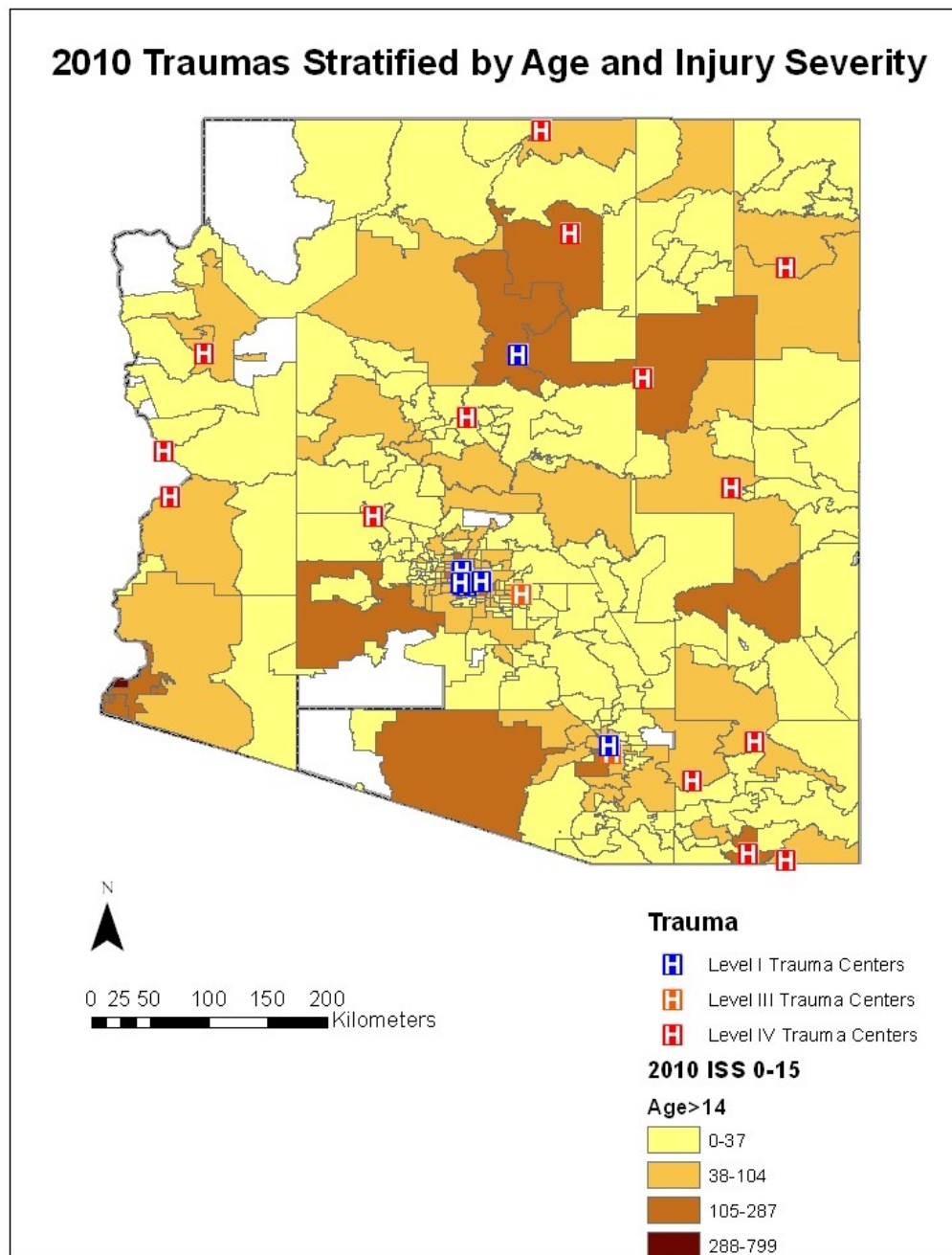
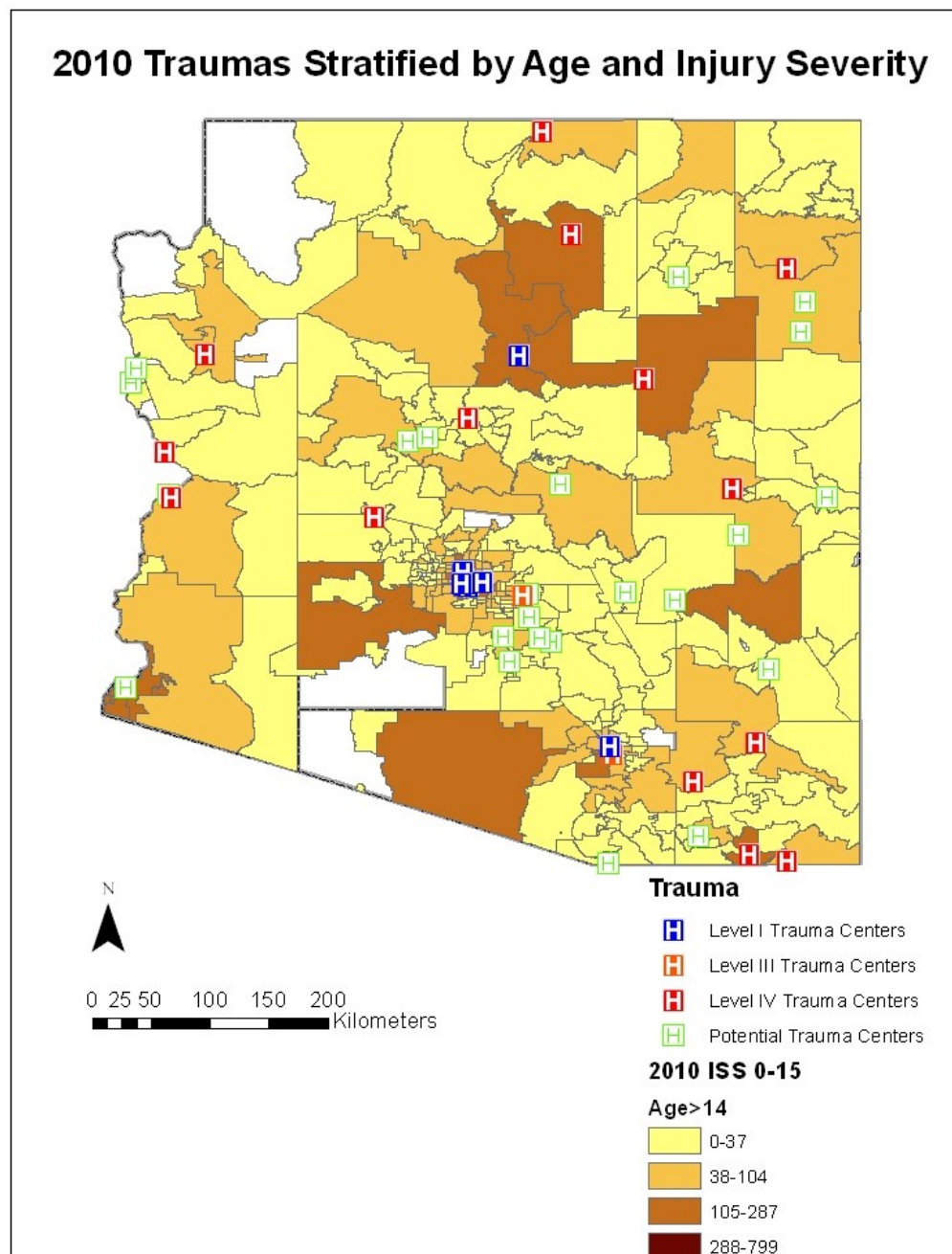


Figure 10. 2010 Adult Traumas (Age > 14) with an ISS < 15 by Incident Site Zip Code with the
Addition of Potential Trauma Centers



Exploratory Analysis: Penetrance

Table 2. Penetrance Results for Level IV Trauma Centers

Facility	Traumas	Catchment Population	Penetrance
Banner Page	36	10,745	3.35
Chinle Comprehensive Health Care	65	48,653	1.34
Copper Queen Community Hospital	209	85,649	2.44
Kingman Regional Medical Center	376	68,199	5.51
La Paz Regional Hospital	85	19,844	4.28
Little Colorado Medical Center	148	74,016	2.00
Northern Cochise Hospital	82	13,421	6.109
Summit Healthcare Regional Medical Center	230	72,371	3.18
Tuba City Regional Health Care Corporation	210	71,491	2.94
Yavapai Regional Medical Center*	170	133,970	1.27
Yuma Regional Medical Center*	2,087	196,473	10.62

*Benson Hospital, Havasu Regional Medical Center, Southeast Arizona Medical Center, Verde Valley Medical Center, and Wickenburg Community Hospital all joined in 2011. *Included numbers from Yuma Regional Medical Center and Yavapai Regional Medical Center (two submitting hospitals to the registry but not State designated trauma centers).*

Conclusion

Currently Arizona's open-designation process for trauma center designation allows any qualifying State-licensed hospital or health care facility to apply for trauma center designation. This legislation may have been adopted to bolster the infrastructure of the trauma system during its infancy; however, ideally, an optimal trauma system would be organized according to the needs of the population served. Arizona shows excellent system coverage in its densely populated urban areas while its rural areas show greater disparities in coverage. The disparities in coverage are not only in the level of trauma facilities, but also overall distances to the nearest trauma facility. The analysis of the trauma numbers by zip code, demonstrate that there are areas of need within Arizona.

Figures 1 and 2 show 2010 rural trauma patients with an ISS < 15 who were transferred to Level I Trauma Centers. This analysis shows potential lower level trauma center locations where rural patients without major traumas could be treated based on the assumption that patients with an ISS < 15 can be routinely treated in a facility with less capabilities than Level I Trauma Centers. Figures 1 and 2 also show a dichotomy of the current organization of trauma facilities and potential trauma facilities derived from a list of state licensed hospitals. Spatial gaps, areas dense in trauma incidence without a trauma facility in the same zip code, are evident. Areas that show these spatial gaps and are potential areas for new trauma centers are Nogales, Safford, Globe, west of Flagstaff, Payson, and Camp Verde. Areas in the mid north-eastern and north-western parts of the state also demonstrate little coverage per square mile. Population density is minimal in some of these areas; however, in order to adhere to the

“Golden Hour” standard, more coverage is needed. The southwestern corner of the state does not show up on the map as an area of high density trauma incidence, however, further analysis demonstrates that a large of trauma cases actually occur and are treated in this area. Further explanation will follow.

Figures 3 and 4 show 2009 pediatric trauma (Age ≤ 14) with an ISS < 15 . Pediatric traumas were separated from adult traumas because age specific care is optimal for the treatment and care of the young. Because pediatric traumas are less frequent than adult traumas it makes more fiscal sense, under the current financial climate, to train facilities which receive and treat a high density of pediatric traumas rather than organize a separate pediatric trauma system. As noted above, there is a high density of trauma cases in the southwest corner of the state, where the city of Yuma is located. Yuma has a well-developed sizeable medical facility that is capable of handling traumas; however, it does not hold state trauma designation. Other areas of observed need are Nogales, Globe, and Safford.

Figures 7 and 8 show 2010 pediatric traumas with an ISS < 15 . Similar regions demonstrating spatial gaps exist along with another area that reported increased numbers of trauma incidents, southwest of Phoenix. This zip code coincides with two major interstates that run through Arizona - Interstate 10 and Interstate 8. These are highly trafficked and small cities exist along these roadways. No state licensed hospitals operate in the vicinity, giving smaller clinics the potential to participate in the state’s trauma system. Currently, victims of accidents occurring along these interstate highways will be immediately transported to either Yuma or

Phoenix depending on their proximity. The 2010 maps also clearly show similar spatial gaps in state trauma system coverage.

Figures 5 and 6 show 2009 adult traumas (Age > 14) with an ISS < 15. Areas of interest are Yuma, Globe/Safford, and Nogales; areas that were also identified in the pediatric trauma analysis. Payson shows up on the map as a potential gap in coverage and its hospital should be considered for trauma system designation. Also, Flagstaff is in a high density area of traumas with some incidents likely originating from the Grand Canyon. There is no licensed hospital at the Grand Canyon, but designating a local clinic could mean that patients with less severe trauma will not require transport to Flagstaff.

Figures 9 and 10 show 2010 adult trauma's with an ISS < 15. An area not previously depicted presents itself in the southern portion of the state. The majority of this land belongs to the Tohono O'odham Nation. In this region, the cities of Lukeville or Ajo would be likely candidates for a trauma facility. There appears to be an increase in the incidents of trauma in the surrounding zip codes, especially in the northeastern section of the state. This provides more evidence supporting the development of a level IV trauma center closer to the Grand Canyon. Lastly, coverage along the western portion of the state's major interstates appears to be adequate. However, as previously stated, smaller cities and clinics could provide improved coverage and care.

The exploratory analysis of this study uses penetrance to examine trauma center effectiveness and workload. Penetrance is a novel approach adopted from a report which examined poison control call centers workload and need within their catchment areas in

California. For penetrance, a clear defined catchment area must be established using a population or geographical marker such as zip code. A service industry can then use penetrance to look at the overall use of the service and need for expansion of services offered based on a standard comparator. A trauma center could use this novel approach to gauge the size of a catchment area and the usage for a current facility as well as the impact of the addition of a new facility in its current catchment area. A facility showing high levels of penetrance, depending on the size of the catchment area served, could benefit from additional treatment facilities in its catchment area. Penetrance could also be beneficial in an analysis of adherence to the “Golden Hour” by specifically looking at catchment areas of treating facilities. Ideally, time series analysis would be the most appropriate use of penetrance and with the rapidly changing landscape of the Arizona State Trauma System it may be several years away from it use.

Given that there is not a state or national standard for trauma center penetrance, Table 2 was created as a comparative analysis with the other trauma centers in the state. Yuma Regional Medical Center and Northern Cochise Hospital show the highest levels of penetrance. These hospitals show the highest treatment numbers at their facilities by catchment area. Yuma Regional Medical Center’s numbers are less relevant as the target of this analysis was designated towards potential Level IV Trauma Centers. ACS defines Level I or II Trauma Centers volume requirements as needing, “at least 1,200 trauma patients yearly or have 240 admissions with an ISS > 15.”³ In 2010 Yuma treated 2,087 total traumas and if state designated would they would qualify to be designated as either a Level I or II Trauma Center.

Northern Cochise Hospital is in Willcox, Arizona. Nearby areas like Safford and Globe were previously identified as potential targets for a Level IV Trauma Center and could affect Northern Cochise's penetrance. Other facilities such as La Paz Hospital, Kingman Hospital, Banner Page Hospital and Summit Healthcare Regional Medical Center all show moderate levels of penetrance in the comparison. Summit Healthcare Regional Medical Center is located in Show Low, Arizona. The Show Low area also shows a large number of rural traumas as indicated by the arcGIS figures. A designated Level IV Trauma Center in nearby Globe and/or Safford could affect the penetrance numbers for Summit Healthcare. Kingman Hospital and La Paz Hospital, which are in Kingman and Parker, Arizona respectively, are along the western border of the state and are also in close proximity to a trauma center in Lake Havasu City. Havasu Regional Medical Center was not included in the analysis due to its date of designation, January 1, 2011. Including Havasu Regional Medical Center in my analysis would have potentially lowered the penetrance values calculated for La Paz Hospital and Kingman Hospital. Also designating a trauma center in a city like Quartzite, Arizona; located directly on Interstate 10, could aid in the stabilization, treatment, and triage of those injured on this roadway.

Banner Page in Page, Arizona, is in the northern part of the state and has potential to treat trauma cases from Colorado. Collaboration with the state of Colorado, which already has a well-established and mature trauma system, might be one way to address service in this region. The remaining investigated facilities demonstrate low levels of comparative penetrance. Yavapai Regional Medical Center which is not currently a designated trauma center shows the lowest value for penetrance for all the facilities examined. However, Yavapai has one of the

largest catchment areas. It exists in an area that was identified in the primary analysis as a potential location for a designated trauma center. Penetrance has the potential to be a meaningful analysis tool of a more established trauma system. Using a time series analysis trends in system usage and catchment area will provide more insight to the overall use of the system.

Discussion/Recommendations

A statewide trauma system is an important part of the public health system. The current leadership at ADHS and BEMSTS have worked hard to make the Arizona State Trauma System more inclusive and more effective and have made excellent progress. Using a primary core public health tenet – assessment, this analysis looked at the availability of optimal emergency treatment for traumatic injury in the state of Arizona, focusing specifically on the strengths and weaknesses of the current rural trauma network. Initially, this project was to look at the current status, statewide, of the Arizona State Trauma System, and to assess Arizona’s open voluntary trauma designation process. The scope of the project had to be later narrowed because of limitations in time and resources during my internship period. The focus became evaluating the Arizona State Trauma System across rural Arizona analyzing for spatial gaps in coverage. Rural inhabitants in this state experience known disparities in other areas of health care such as; lack of access, quality of care, lack of insurance coverage, lack of privacy, etc; and the findings regarding access to treatment following traumatic injury are no different.

Some policy recommendations that came out of this analysis include:

- Increase overall statewide trauma system participation, mainly Level IV

Trauma Centers

Most western states with comparable legislation to Arizona, which mandates open voluntary participation in the State Trauma system, have significantly more designated trauma centers than Arizona.

Table 3. Numerical Trauma Center Designation by State

State	Level I	Level II	Level III	Level IV & V	Total	Total by Square Mileage*
Arizona⁴	8	0	0	15	23	2.02
California⁹	10	40	13	9	72	4.62
Colorado¹⁰	4	9	17	40	70	6.75
Minnesota²⁵	4	11	32	82	129	16.20
Montana²⁶	0	4	4	31	39	2.68
New Mexico³³	2	1	5	2	10	0.82
Oregon³⁴	2	4	13	25	44	4.58
Texas³⁷	17	11	53	186	267	10.22
Utah⁴³	3	3	1	9	16	1.95
Washington⁴⁴	2	6	31	61	100	15.05

**Total by Square Mileage is a calculation based on the 2010 census recorded populations. The total number of trauma centers was divided by the square mileage for the state and then multiplied by 10,000⁴¹*

Arizona has comparable, if not better, coverage for the highest level of trauma care. However, it has fewer lower level trauma centers as compared to other states. It also has fewer

trauma centers per square mile than other states. Increasing the number of small rural hospitals and clinics participating in the trauma system would lead to better coverage and a more robust statewide network. The results of the analysis clearly show a need and potential for designating rural hospitals as lower level trauma centers. There are limitations to this recommendation. One limitation is that a large amount of land in the state of Arizona belongs to Native Americans. For an agreement to be made the state of Arizona will have to work directly with Indian Health Services, which operates the health care systems on tribal lands. Other limitations include lack of funding and resources for BEMSTS to conduct site visits and process applications as well as monitor quality.

- Increase access to trauma care for rural Arizonans through the designation of Level V Trauma Centers.

Developing a regulatory process as well as an application process for Level V Trauma Centers could help build a more robust statewide trauma system. Rural Arizona would benefit from improved coverage and one avenue is the inclusion of health clinics and other smaller medical practices in the trauma system. Level V Trauma Centers could fill a variety of needs, including: minor trauma care and discharge, quicker triaging, improved communication, and improved stabilization and transfer of the severely injured. Expanding the system to include Level V Trauma Centers could enhance knowledge of trauma prevention and treatment across the state and greatly improve access to timely treatment. Passing the legislation for the creation of Level V Trauma Centers is a significant barrier along with allocating the funds and resources for monitoring and maintaining these trauma centers.

- Require all licensed hospitals in the state to enter data into a secure web-based trauma registry and provide training at trauma centers for effective use.

Data collection and analysis can aid in understanding trends in trauma and trauma care, and in reducing its incidence. Numerous Arizona hospitals currently submit trauma data to the ASTR. Those that are designated by the state as trauma centers are required to participate. Other hospitals such as Yuma Regional Medical Center and Yavapai Regional Medical Center voluntarily participate. However, a majority of non-designated state hospitals, smaller rural hospitals, and clinics do not participate. The most common complaints about involvement are lack of personnel to organize hospital data, lack of time, and lack of funding. A majority of Arizona hospitals agree with the relevance of submitting these data; however, there is currently little incentive to participate.

If full participation is desired, a policy change can have an immediate impact in this area. One simple change would be to mandate that all licensed hospitals are required to participate. A committee could be organized by BEMSTS to insure adequate technology exists for participation and train several committee members to be able to run in-service programs to ensure proper understanding and use of the software. This idea is based on a process that the Minnesota Trauma Program Director said proved to be instrumental in advancing the submission of data to their state trauma database. The requirement for new funding and resources is the most significant limitation to this recommendation.

- Institute an employee swap program that allows doctors and managers from Level I Trauma Centers to experience care in Level III, IV, and V trauma centers and vice versa.

ACS encourages a trauma system built upon a free flowing environment of education and communication. One way in doing so is by allowing members of participating trauma hospitals to actively engage in the Arizona State Trauma System's development and quality improvement. Instituting a program allowing trauma surgeons and other participating medical staff temporary relocation, gives them the opportunity to witness and assist in the delivery of trauma care to patients in various settings across the state. The immediate gains from such a program would be enhanced communication and education. Many practitioners in urban areas like Phoenix and Tucson could benefit from seeing the challenges that exist in providing trauma care in rural facilities. Their rural counterparts could engage in the fast paced trauma care that exists in a tertiary, Level 1 Trauma Center. One of the biggest challenges facing rural practitioners, as one systems director described, "is a lack of education in dealing with trauma's and not having the means available to grow their expertise in trauma care."¹⁵

The aforementioned exchange program would allow for continued education and build rural practitioners' confidence that effective care can be provided in rural settings, and could lead to more timely and effective trauma care throughout the state. The program would also help strengthen the personnel network of the Arizona State Trauma System and allow active participants to coordinate and communicate how to best serve the states severely injured. No professional program like this currently exists; however, a similar system is used in the

education of medical students. There are several limitations that stand in the way of this program. Voluntary participation may be limited due to family and practice demands. Inexperienced participants would likely be limited to assisting. State funding would be required for travel, lodging, and per diem and for fill-in providers.

- Create a robust education system that allows rural trauma center personnel to become skilled in the provision of care for injured patients

Another way that the state can aid trauma system development is to bolster the availability of educational resources to rural trauma providers. The state of Minnesota has developed a continuing education system provides continuing education for health care providers.¹⁵ Personnel in rural trauma centers and rural hospitals who see trauma infrequently become less confident in their ability to treat trauma over time. Ongoing trauma education could instill more confidence and encourage rural hospitals to join the trauma system.

- Temporarily hold off approving for new trauma center applications in Phoenix and Tucson until there is better statewide coverage.

Currently, patients injured in close proximity to Phoenix or Tucson have the best access to appropriate level trauma care. These cities have many facilities capable of providing emergency trauma care and nearby Level I Trauma Centers. ADHS could restrict new entrants in Tucson and Phoenix and place a greater focus on designating new trauma facilities in rural Arizona. As the system grows, this could possibly result in newly graduated trauma professionals becoming more interested in working in rural Arizona.

- Each of the four EMS regions should have a lead hospital that works to further regional development.

Arizona has well established EMS regions with each having a recognized leadership group. The EMS regional councils are private, non-profit entities contracted with ADHS. The underlying theory behind dividing a state into various medical regions is that it enables individuals, knowledgeable of their specific region, to make recommendations and to oversee the individual trauma systems in their respective regions. Regional directors understand the nuances that lie in their regions and should be the most knowledgeable about the strengths and opportunities for improvement in their regions. If regions were given more autonomy, the directors could help better identify local trends and needs, and establish new Level V trauma centers. In addition, effectively it will be establishing four smaller systems inside the Arizona system. Doing so should place more attention on serving rural areas as well as being able to diagnose special areas of tourist travel or areas of unique trauma incidence. Regional directors will be directly involved in establishing the need and placement of Level V Trauma Centers to adequately serve those unique areas. While, the EMS regions will still work closely with ADHS the authority for trauma center designation would still remain with ADHS.

This recommendation has several limitations. A more decentralized system may not be advisable from a management perspective or politically feasible. Establishing lead hospitals could prove difficult in rural areas. Local politics could influence lead hospital designation and working relationships. Lastly, a transfer of funds to the regions would be required.

- Speak with surrounding states and develop partnerships for potential dual designated hospitals or collaborative efforts to create hospitals on state borders

Border hospitals recognized as trauma centers by more than one state are not unique.

The state of New Mexico has collaboration with Texas and shares two trauma centers designated by both states. Minnesota also shares trauma centers with three of its bordering states; North Dakota, South Dakota, and Wisconsin. To share hospital designation requires collaboration and agreement between participating states. Collaboration among bordering states is a project that is already underway at BEMSTS. While still in its infancy, BEMSTS leaders foresee and understand the importance of cross-state communication and collaboration. Border counties are often rural and relatively sparsely populated, as is the case for surrounding states. By combining efforts and resources, optimal coverage without wasteful duplication of effort can be achieved.

The U.S.-Mexico border was not explicitly studied in this project. Communication between nations and nation states has increased over the past decade. Arizona has the opportunity to become a leader in achieving a healthier U.S.-Mexico border. The ADHS Office of Border Health coordinates with Sonora, Mexico, and is working to strengthen the public health system in Arizona and the Border Region.

- Create a traveling presentation for physicians, other health care workers, and administrators to encourage trauma system participation

This idea is based on a strategy used in the past to inform state licensed hospitals of the benefits of participating in the state trauma system. State trauma system directors I interviewed, emphasized that rural hospitals often want to be involved and that their reasons are not principally financial.^{15,18,22} Other reasons include the desire to provide care for community members and to be able to keep them close to home.^{15,18,22} The presentation could use parts of an earlier presentation on financial reimbursement. However, it should focus more on helping community members receive care close to home. A small focus group of employees from Level IV Trauma Centers and the Office of Rural Health could help develop the presentation. The costs of developing and implementing the presentation represent its main limitation.

- Change the policy regarding system application fees. Eliminate application/re-application and site visit fees; thus eliminating barriers to entry and continuation in the system.

This recommendation could help change the culture around participation in the trauma system and help it be considered more of a badge of honor, so that health service providers all around the state want to be a part of the system. By creating a policy change for the elimination of these fees it could positively motivate hospitals to become involved. Many of the aforementioned recommendations, including this one, would require a significant budget increase and a commitment to the expansion of the state's trauma system. However, expanding the system now could improve the outcomes of trauma patients over the long-term.

These aforementioned recommendations are based on successful innovations in other states. They may or may not be desirable or feasible in Arizona. However, as Arizona continues to expand its trauma system, it can benefit from the experiences and successes of others.

There are several limitations to the analysis portion of the project. The data used in the quantitative analysis are historical data from 2009 and 2010. The exploratory penetrance study could prove to be more useful with a longer period of analysis. Since the inception of this project, many trauma centers have been newly designated that are not shown in this project

Overall, this project was focused on the core function of assessment; although some time was spent developing recommendations for policy change. Of the ten essential public health services, the services addressed in this report were: Monitoring health status to identify community health problems; Diagnosing and investigating health problems and health hazards in the community; Informing, educating, and empowering people about their health issues; and lastly evaluating the effectiveness, accessibility and quality of personal and population-based health services. The last essential service being the most important as the population-based health service examined was the Arizona State Trauma System.

This experience has given me great personal insight regarding the functioning of a bureau in a state health department. It has also enabled me to apply the knowledge gained in my Masters program to a real life public health concern. BEMSTS was an excellent host and my site preceptor went out of his way to ensure that I got the information I needed and to help me grow and learn. The rest of the BEMSTS staff were also very welcoming. I would highly recommend BEMSTS and ADHS to students as an internship sites.

Appendices

A.1 Image of EMS Regions and Trauma Centers

A.2 Table of Original State Designated Trauma Centers

A.3 Citi Certifications

A.4 IRB approval

A.5 ADHS Organizational Chart

A.6 BEMSTS Organizational Chart

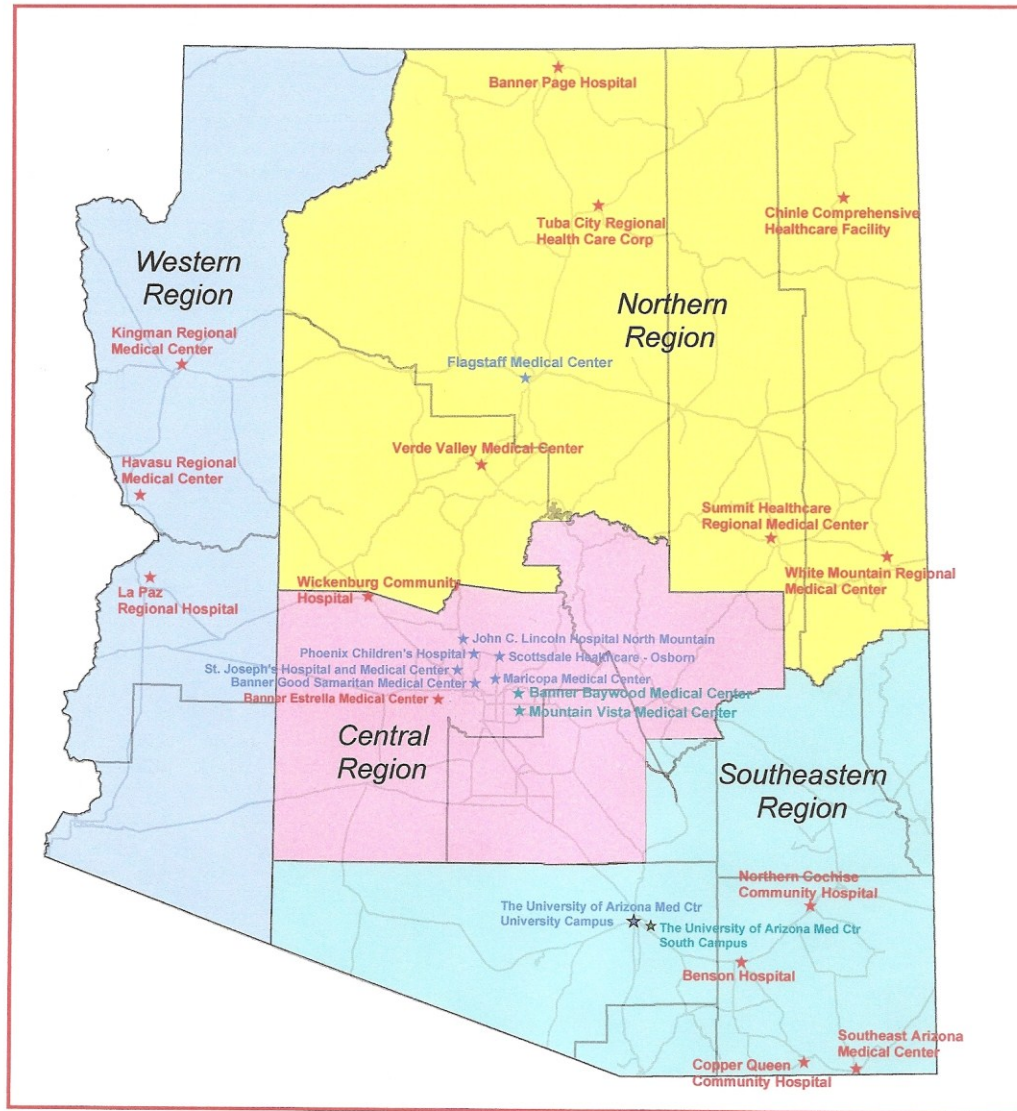
A.7 Timeline of Evolution of Arizona State Trauma System

A.8 List of Abbreviations

A.1 Image of EMS Regions and Trauma Centers

EMS REGIONS AND TRAUMA CENTERS

September 4, 2012



Level I Trauma Center

Level III Trauma Center (Provisional)

Level IV Trauma Center

A.2 Table of Original State Designated Trauma Centers

Arizona State Designated Trauma Centers

Health Care Institution	Address	Effective Date	Expiration Date
Level I Trauma Centers			
Banner Good Samaritan Medical Center	925 E. McDowell Rd., Phoenix, AZ 85006	11/19/11	11/19/14
Flagstaff Medical Center	1200 N. Beaver St., Flagstaff, AZ 86001	05/27/11	05/27/14
John C. Lincoln - North Mountain	250 E. Dunlap Ave., Phoenix, AZ 85020	04/23/11	04/23/14
Maricopa Medical Center	2601 E. Roosevelt, Phoenix, AZ 85008	12/20/11	12/20/14
Phoenix Children's Hospital	1919 E. Thomas Rd., Phoenix, AZ 85016	08/31/09	08/31/12
St. Joseph's Hospital & Medical Center	350 W. Thomas Rd., Phoenix, AZ 85013	11/20/10	11/20/13
Scottsdale Healthcare – Osborn	7400 E. Osborn, Scottsdale, AZ 85251	10/25/11	10/25/14
The University of Arizona Medical Center – University Campus	1501 N. Campbell Ave., Tucson, AZ 85724	11/12/11	11/12/14
Level III Trauma Centers			
The University of Arizona Medical Center – South Campus (Provisional Designation)	2800 East Ajo Way, Tucson, AZ 85713	02/13/12	08/13/13
Level IV Trauma Centers			
Banner Page Hospital	501 N. Navajo, Page, AZ 86040	11/05/11	11/05/14
Benson Hospital	450 S. Ocotillo Ave., Benson, AZ 85602	03/03/11	03/03/14
Chinle Comprehensive Health Care Facility	P.O. Drawer PH, Chinle, AZ 86503	09/09/10	09/09/13
Copper Queen Community Hospital	101 Cole Ave., Bisbee, AZ 85603	12/01/09	12/01/12
Havasupai Regional Medical Center	101 Civic Center Ln., Lake Havasu City, AZ 86403	01/20/11	01/20/14
Kingman Regional Medical Center	3269 Stockton Hill Rd., Kingman, AZ 86409	10/15/09	10/15/12
La Paz Regional Hospital	1200 W. Mohave Rd., Parker, AZ 85344	06/02/09	06/02/12
Little Colorado Medical Center	1501 N. Williamson Ave., Winslow, AZ 86047	03/10/09	03/10/12
Mountain Vista Medical Center	1301 S. Crismon Rd., Mesa, AZ 85209	02/10/11	02/10/14
Northern Cochise Community Hospital	901 W. Rex Allen Dr., Willcox, AZ 85643	12/04/08	12/03/11
Southeast Arizona Medical Center	2174 W. Oak Ave., Douglas, AZ 85607	08/18/11	08/18/14
Summit Healthcare Regional Medical Center	2200 Show Low Lake Rd., Show Low, AZ 85901	08/12/11	08/12/14
Tuba City Regional Health Care Corp.	POB 600, Tuba City, AZ 86045	05/06/09	05/06/12
Verde Valley Medical Center	269 S. Candy Ln., Cottonwood, AZ 86326	08/18/11	08/18/14
Wickenburg Community Hospital	520 Rose Ln., Wickenburg, AZ 85390	08/08/11	08/08/14

02/13/12

A.3 Citi Certifications

Completion Report

<https://www.citiprogram.org/members/learnersII/crbystage.asp?strKey...>

CITI Collaborative Institutional Training Initiative

Human Research Curriculum Completion Report Printed on 1/31/2012

Learner: Matthew Kingry (username: mkingry)

Institution: University of Arizona

Contact Information Department: College of Public Health

Email: matthew.kingry@gmail.com

Social & Behavioral Research Investigators:

Stage 1. Basic Course Passed on 12/13/11 (Ref # 7033123)

Required Modules	Date Completed	Score
UA - Native American Module	12/13/11	no quiz
History and Ethical Principles - SBR	12/13/11	4/4 (100%)
Defining Research with Human Subjects - SBR	12/13/11	3/5 (60%)
Basic Institutional Review Board (IRB) Regulations and Review Process	12/13/11	5/5 (100%)
Informed Consent - SBR	12/13/11	5/5 (100%)
Privacy and Confidentiality - SBR	12/13/11	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects	12/13/11	3/5 (60%)
Biomedical 200 Refresher Course - Research Involving Vulnerable Subjects	11/16/11	1/1 (100%)

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiler Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

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CITI Collaborative Institutional Training Initiative**Human Research Curriculum Completion Report
Printed on 1/31/2012****Learner:** Matthew Kingry (username: mkingry)**Institution:** University of Arizona**Contact Information** Department: College of Public Health

Email: matthew.kingry@gmail.com

Biomedical Research Investigators:**Stage 1. Basic Course Passed on 12/13/11 (Ref # 7033122)**

Required Modules	Date Completed	Score
History and Ethical Principles	11/15/11	6/6 (100%)
Informed Consent	11/15/11	3/4 (75%)
FDA-Regulated Research	11/16/11	4/5 (80%)
Biomedical 200 Refresher Course - Research Involving Vulnerable Subjects	11/16/11	1/1 (100%)
Research and HIPAA Privacy Protections	12/13/11	4/5 (80%)
Conflicts of Interest in Research Involving Human Subjects	12/13/11	3/5 (60%)
Basic Institutional Review Board (IRB) Regulations and Review Process	12/13/11	5/5 (100%)
UA - Native American Module	12/13/11	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiler Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

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A.4 IRB Approval

Mel & Enid Zuckerman College of Public Health
Non-Applicable Form for a Student Field-based Project

*(***Note: This form is used for projects which do NOT involve human subjects, (i.e. course/ program/policy development, or evaluation, etc., OR uses data which is de-identified or is already public domain ***)*

PRINCIPAL INVESTIGATORS: Name(s) of both Advisor and Student:
 (By signing this form (below) the student and advisor assure that all information provided on this form is accurate and complete.)
 (**Please type this form out OR please write legibly.)

Student Name: Matthew Kingry (MEZCOPH) Advisor Name: Dr. Kenneth Schachter
 Student Email: mkingry@email.arizona.edu Advisor Email: kschacht@email.arizona.edu
 Title of Project: Redefining Arizona's Trauma System
 Project Period: 1/1/12 to 5/31/12 Project Location and Sponsoring Agency (if pertinent): AZDHS

Is this an MPH ☒ or MD-MPH ☐ (select one) internship project? Yes ☒ No ☐ If no, for what course or program or purpose is this project being performed?
 (**Note that this form does not apply if you are an MS or PhD student, since these programs require thesis publication. **)

Human Subjects Certification Completed? Yes ☒ No ☐ Date of Completion: 12/13/11
 Please indicate which CITI certification test completed: SBR ☒ BIOMED ☒ (attach completion report) ☒
 Do you intend to present (poster or presentation) this project at any other academic or public forum other than the MEZCOPH Internship Conference? Yes ☐ No ☒
 Does the student (or advisor) intend to have the results of the project published in any way? Yes ☐ No ☒

(1) Purpose and Objectives of Project: (Describe the details (briefly) of what you will be doing in this project.)
 Please type this out on a separate Word document & only provide a brief paragraph summary.
 ***DO NOT cut and paste your MEZCOPH Internship Plan/Contract or paste an Abstract**

(2) Check the appropriate category(s) for why this project should be considered as Non-applicable to Official IRB review and explain "why": ☐ No Human Subjects Involved ☒ Using publicly available Data
☐ Creating a course/program ☐ Evaluating a program ☒ Using De-identified data (must provide an auth letter)

(2B) Provide an explanation with your Objectives summary above, and only provide a brief paragraph.
 DO NOT cut & paste your MEZCOPH Internship Plan or attach research definitions

Student Signature: [Signature] (MEZCOPH) Advisor Signature: [Signature]
 Student Contact Phone: (440) 453-7997 Advisor Contact Phone: (520) 626-7960
 Date: 1/5/12 Date: 1-6-12

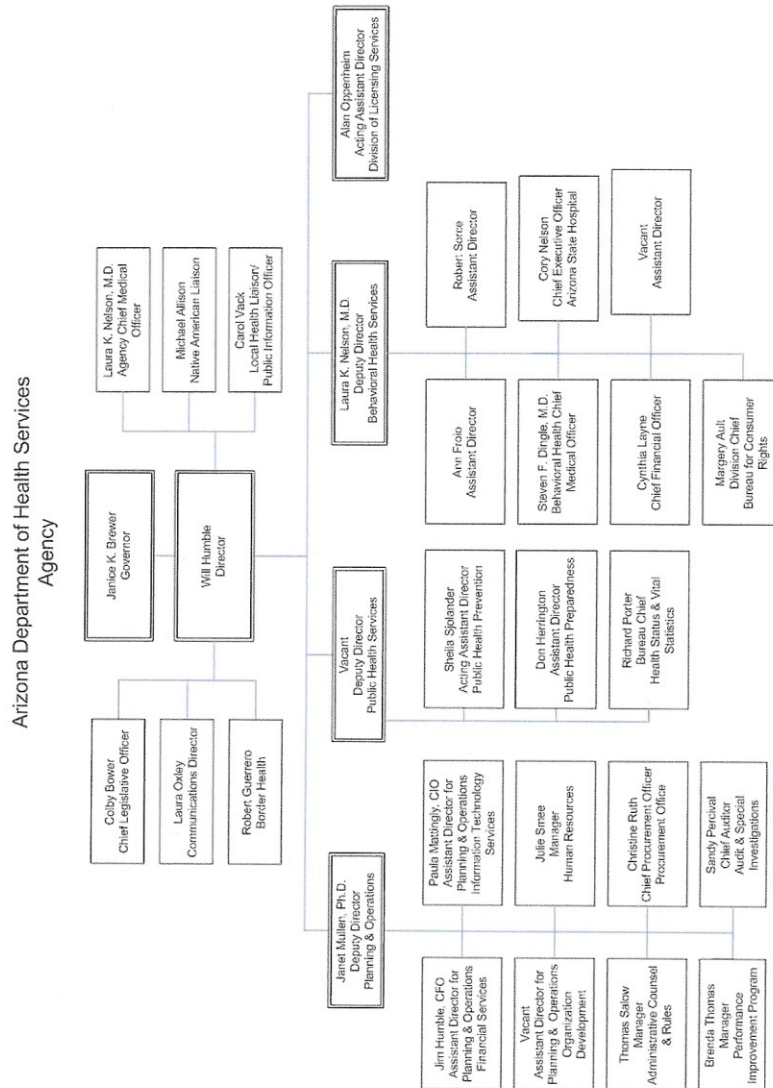
(By signing above, the Student and Advisor verify that the proposed student project falls entirely within the scope of the MEZCOPH Non-Applicable requirements, including that any data used are based on publicly available or previously collected de-identified data as defined on page 2 of this form.)

If questions, please contact Dr. Duane Sherrill at (520) 626-7513, dls3@email.arizona.edu
 OR Suzanna Trejo at 626-8315, suzanna@email.arizona.edu
 When completed, turn form in to:
 MEZCOPH Research Office (Rm A317C or A317DD)
 PO Box 245163, Tucson, AZ 85724 (Fax: 520-626-6093)

Revised: 2.7.11

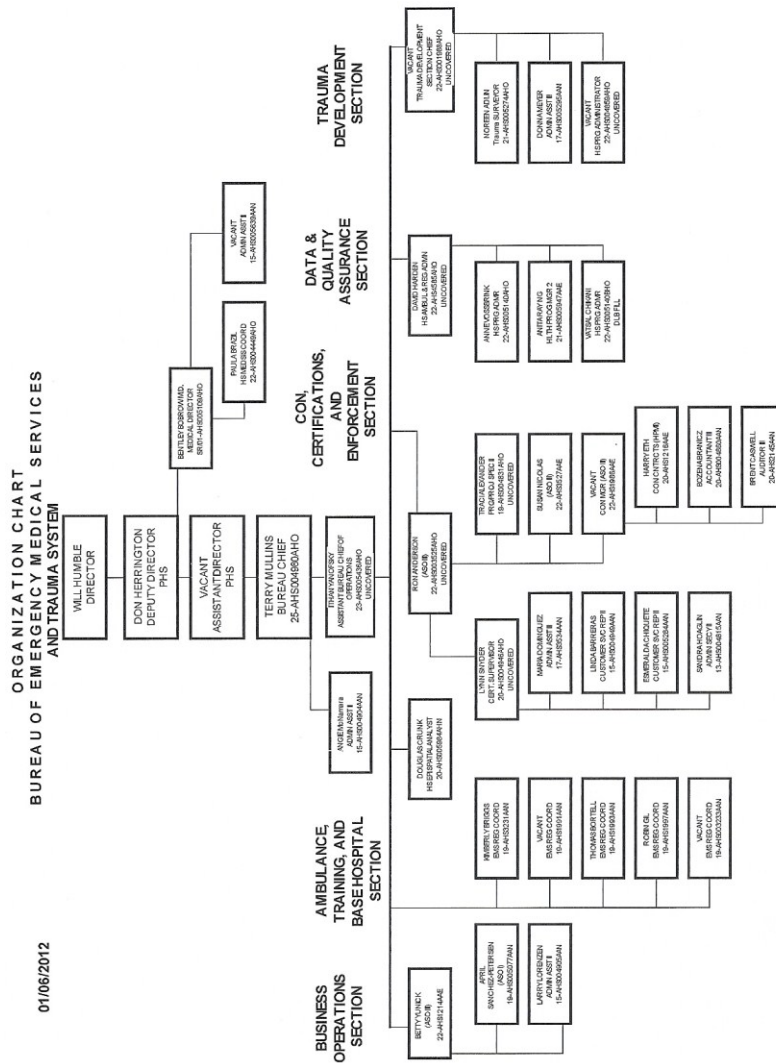
DLS
Approval Initials

A.5 ADHS Organizational Chart



November 25, 2011

A.6 BEMSTS Organizational Chart



A.7 Timeline of Evolution of Arizona State Trauma System to 2005

EVOLUTION OF EMS and TRAUMA SYSTEMS IN ARIZONA

Bureau of Emergency Medical Services

Arizona has been working towards a statewide trauma system, as a specific subset of the overall EMS system, since the early 1990s when a Trauma System Task Force was established. In 1993, Arizona house bill (HB 2208) established a Statewide Trauma Task Force that began meeting to recommend the development of state legislation for the establishment of a state trauma registry and trauma system. Several legislative initiatives were approved that began to frame the components of a statewide trauma system. The following chronological events demonstrate the various historical proceedings that have impacted the program to the current time:

- 1966 Federal leadership, spurred on by the White Paper titled: "Accidental Death and Disability," that enacted the 1966 Highway Safety Act provided the states authority to set standards and regulate EMS.
- 1973 Emergency Medical Services Act (PL 93-154), and modified in 1976, mandated that any EMS programs that were federally funded by DHHS would address a coordinated approach on a regional basis for emergency response, thus served to stimulate the development of regional EMS systems.
- 1981 ARS §36-2208 Division of emergency medical services. Amended by Laws 1992, 1993, 1994.
- 1981 The DHHS program that supported EMS programs was folded into the Preventive Health Block Grant, and guidance to regionalized care soon dissolved. Many state EMS offices disappeared.
- 1981 In Arizona, each of the four regions consisted of a Council of Governments that funded with Federal grant monies a regional EMS council:

Central Region	Valley Medical Systems	→→→Arizona EMS (AEMS)
Southeast Region	Southeast EMS Council	
Northern Region	Northern EMS Council	
Western Region	Western EMS Organization	→→→Western EMS Council
- 1983- Regions continued to be supported with grant monies thru the Council of
- 1985 Governments.
- 1985 ARS § 36-2218 Emergency Medical Services operating fund. The Director administered the monies from the State general funds via contract to the Councils.
- 1990 The Trauma Care Systems Planning and Development Act of 1990 established the Federal Model Trauma Care Plan which states could use as a reference guide in the development of a comprehensive trauma care system plan as part of the statewide EMS plan.
- 1993 ARS § 36-2208, amended to include "coordinating, establishing and administering a statewide system of emergency medical services, trauma care and a trauma registry." ARS § 36-2210 Local emergency medical services coordinating systems. The department shall contract with a local emergency medical services coordinating system

which conducts needs assessments and plans and coordinates a regional emergency medical and trauma services system within a designated planning area.

- 1994** ARS § 36-2222 Trauma advisory board that shall recommend standards to establish a statewide trauma system and a trauma registry
- 1997** Funds were dwindling and allocations to Councils amounted to as little as \$24,500 annually.
- 1997** ARS § 36-2219.01 Medical services enhancement funds (fines/penalties) established the EMS operating fund for funding local and state emergency medical services systems based on the needs assessment of the local emergency medical services coordinating system plans.
- 1995 –**
- 1999** State Trauma Advisory Board developed trauma plan recommendations that were presented to the Director of the Department of Health Services.
- 2001** Director of the ADHS directed a focus on a comprehensive EMS and Trauma System and completion and implementation of a consolidated, comprehensive statewide EMS and Trauma System Plan.
- 2002** Arizona EMS and Trauma System Plan approved and adopted.
- 2002** A collaborative regional planning process, enabled by statute mandating regional EMS and trauma coordinating systems plans was begun. Using the same Federal Trauma Care Plan as a format, regional planning was to begin by completing a regional profile and a needs assessment report. Regions were provided \$8,000 in addition to the annual regional contract allocation amount of \$144,000 to initiate the more comprehensive data collection project at that time. To follow was the development of a Regional EMS and Trauma Systems Plan based upon the gaps identified in the regional needs assessment mandated by statute. The final EMS and Trauma Regional Plans were then to be integrated into the statewide EMS and Trauma System Plan.
- 2004** House Bill 2197 introduced in the Arizona Legislature that requires the Department of Health Services to develop and administer a statewide emergency medical services (EMS) and trauma system. The bill listed a number of components to be developed through the rulemaking process. HB 2197 passed with an effective date of August 25, 2004.
- 2005** Senate Bill 1134 introduced in the Arizona Legislature that provides the statutory authority for the Department of Health Services to allow for trauma center designation based on a determination by a national verification organization that a health care institution meets the state standards established by rule for designation as a trauma center or a health care institution's verification as a trauma facility by a national verification organization. During the trauma center designation rulemaking process there was a challenge to the draft rulemaking concerning the Department's authority to utilize a third party in this process. This bill passed with an immediate effective date of April 11, 2005.

A.8 List of Abbreviations

AAC – Arizona Administrative Code

ACS – The American College of Surgeons

ACT-COT – The American College of Surgeons Committee on Trauma

ADHS – Arizona Department of Health Services

AHCCCS – Arizona Health Care Cost Containment System

ASTR – Arizona State Trauma Registry

BEMSTS – The Bureau of Emergency Medical Services and Trauma Systems

CITI – Collaborative Institutional Training Initiative

EMS – Emergency Medical Services

EMSS – Emergency Medical Service Systems

HP2020 – Healthy People 2020

HRSA – Health Resources and Service Administration

ISS – Injury Severity Score

NHTSA – National Highway Traffic Safety Administration

NTD – National Trauma Database

OBH – Office of Border Health

SAS – Statistical Analysis Software

STAB – State Trauma Advisory Board

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